Red Sea Research Center Symposium

Session Topic: Modeling & Analyzing the Red Sea Physical & Biological Environments
Session Leaders: Prof. Georgiy Stenchikov and Prof. Ibrahim Hoteit

---

Elie Bou-Zeid, Princeton University, New Jersey, USA

Title: Experimental and Numerical Studies of Atmosphere-Water Interactions

Abstract: Understanding and quantifying the interaction of the atmosphere with underlying water surfaces is of great importance for a wide range of scientific fields such as water resources management, climate studies of ocean-atmosphere exchange, and regional weather prediction in coastal areas. However, atmospheric dynamics over water surfaces have generally received less attention than land-atmosphere interactions, partially due to logistical difficulties in operating in-situ field studies.

Recently, numerical simulations and novel experimental campaigns have begun to bridge this gap and are helping improve our understanding of energy and mass exchanges at the air-water interface. In this talk, results from the Lake-Atmosphere Turbulent EXchanges (LATEX) field measurement campaign, which was performed over Lake Geneva (Switzerland), and Large-Eddy Simulations are combined to investigate the relatively simple case of atmosphere-water interaction where the effect of the waves on atmospheric turbulence is minimal and the dynamics of the air-water interactions are mainly atmosphere-driven.

The diurnal trends of momentum, water, and heat fluxes are analyzed and a new evaporation model is proposed for wet surfaces based on sensible heat flux measurements. The difference between the turbulent fluxes of momentum and scalars (heat and humidity) is then investigated and found to be related to the coherent turbulent structures and how they are modulated by buoyancy. Finally, simulations over transitions from wet-to-dry and dry-to-wet surfaces allow a quantitative analysis of surface atmosphere exchanges in coastal areas over both the water and land sides.